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BOTANICAL GAZETTE

MARCH, 1892.

Flowers and insects. VII.

CHARLES ROBERTSON.

MARTYNIA PROBOSCIDEA Glox.—I know of but one station for this plant—on the banks of the Macoupin Creek, where it appears to be indigenous.

The pale bluish corolla measures about $5\frac{1}{2}$ cm. in length, its tube about $3\frac{1}{2}$ cm. The tube within is finely spotted with bluish; on the lower wall there are about three orange lines leading from the narrow part of the tube and expanding in a large spot on the lower lip. The throat above is spotted with reddish, on the sides with bluish. The middle lobe of the lower lip is streaked with bluish and is straight, while the others are reflexed.

The anthers lie against the upper wall in the median line, with their cells directed longitudinally. The stigma is in advance of them and closes when touched, as observed by Delpino.¹ The narrow part of the tube is about 8 mm. long which with other characters of the flower seems to indicate an adaptation to long-tongued bees. I have found the flowers in bloom from Aug. 19 to Sept. 14. Sept. 3, 1890, I saw *Bombus americanorum* F. ♀ sucking the honey, its thorax being streaked with pollen.

At Metropolis, Ill., Aug. 14, Mr. C. A. Hart found it visited by *Xenoglossa brevicornis* Rab. (MS.) ♂ ♀.

DIANTHERA AMERICANA L.—The plant is rather common in shallow water of streams, the stems rising from 3 to 9 dm. and bearing small clusters of purplish flowers.

The flowers are proterandrous. The two-lobed upper lip stands erect and is strongly marked with purple. The lower lip is formed by three widely divergent lobes, which are white, the middle one with much purple.

¹Sugli apparecchi delle fecondazione nelle piante antocarpee, 1867.
Vol. XVII.—No. 3.

A straight stamen stands on each side. The anther cells are widely separated; one stands vertically, facing the corresponding cell of the other stamen; the other, the outer one, is placed horizontally and has its dehiscent surface turned upwards. The stamens stand so erect that at first I wondered how the bee would come in contact with them. I also wondered why the anther cells are at right angles to each other. As a rule, only two flowers are in bloom in the umbel-like cluster at a time. The three lobes of the lower lip, which we have observed are strongly divergent, are curved upward, so that it is most convenient for the bee to enter between the middle and one of the lateral lobes. In this way it is apt to brush the vertical face of the inner anther-cell. To reach the other flower, the bee crawls directly upwards and approaches it from above. In crawling up out of one flower and down into the other the bee is likely to touch the horizontal faces of the outer anther-cells.

The corolla tube is about 5 mm. long, so that the nectar can be obtained by tongues of medium length. The flower is evidently adapted to bees, but is often visited by flies and butterflies. I have found it in bloom from June 23 to Aug. 24. On July 5 and 9 I observed the following visitors:—

Hymenoptera—*Apidae*: (1) *Apis mellifica* L. ♂, s., ab.; (2) *Bombus virginicus* Oliv. ♀, s.; (3) *Melissodes palustris* Rob. ♂, s., ab.; (4) *M. bimaculata* Lep. ♂♀, s., ab.; (5) *Ceratina dupla* Say ♀, s.; (6) *Epeolus lunatus* Say ♂♀, s.; *Andrenidae*: (7) *Agapostemon nigricornis* F. ♀, s.; (8) *A. radiatus* Say ♂♀, s.; (9) *Augochlora pura* Say ♀, s. and c. p., ab.; (10) *Halictus lerouxii* Lep. ♂♀, s., ab.; (11) *H. ligatus* Say ♂♀, s.; (12) *H. fasciatus* Nyl. ♂♀, s.; (13) *H. pilosus* Sm. ♀, c. p.; (14) *H. confusus* Sm. ♀, c. p., ab.

Diptera—*Syrphidae*: (15) *Allograpta obliqua* Say, f. p.; (16) *Mesograpta marginata* Say, f. p.; (17) *Sphærophoria cylindrica* Say, f. p.; (18) *Eristalis tenax* L., s. and f. p.; (19) *Helophilus laetus* Lw., f. p.; (20) *Tropidia quadrata* Say, s., freq.; (21) *Syritta pipiens* L., f. p.

Lepidoptera — *Rhopalocera*: (22) *Pieris rapae* L.; (23) *Phyciodes nycteis* D.-H.; (24) *Lycaena pseudargiolus* B.-L.; (25) *Pamphila metacomet* Harr.; (26) *Pholisora catullus* F.—all s.

VERBENA STRICTA Vent.—The plant is quite common. The stem rises from 5 to 10 dm. and bears numerous erect spikes of blue flowers.

The corolla tube rises directly upward, bending outward above and joining the vertically expanded border, which is five-lobed and somewhat two-lipped, expanding from 6 to 12 mm. The tube is about 5 mm. long, is quite narrow and is closed at the mouth by a dense circle of hairs.

The flowers appear homogamous and I see nothing to prevent an insect's proboscis from carrying pollen from the anther back to the stigma of the same flower, though if the proboscis is thoroughly dusted with pollen from another flower, cross-pollination may be more likely.

I have found the flowers in bloom from June 15 to Sept. 16. On nine days, July 9—Aug. 7, I observed the following insects sucking the nectar:—

Hymenoptera—*Apidae*: (1) *Apis mellifica* L. ♀; (2) *Bombus virginicus* Oliv. ♂; (3) *Melissodes aurigena* Cr. ♂; (4) *M. perplexa* Cr. ♂♀, ab.; (5) *Ceratina dupla* Say ♀; (6) *Epeolus mercatus* F. ♂; *Sphecidae*: (7) *Ammophila procera* Klug.

Lepidoptera—*Rhopalocera*: (8) *Pieris protodice* B.-L.; (9) *P. rapae* L.; (10) *Danaïs archippus* F.; (11) *Pamphila peckius* Kby.; (12) *P. cernes* B.-L.; (13) *Pholisora catullus* F.; (14) *P. hayhurstii* Edw.; (15) *Eudamus tityrus* F.

Diptera—*Bombylidae*: (16) *Exoprosopa fasciata* Mcq. ab.; *Conopidae*: (17) *Stylogaster neglecta* Will.; *Syrphidae*: (18) *Eristalis tenax* L.

VERBENA HASTATA L.—This plant is less abundant than the last, grows taller and bears small spikes and smaller blue flowers.

The border is 3 to 5 mm. across and the tube 3 or 4 mm. in length.

I have found it in bloom from July 12 to Sep. 23. On 8 days, July 12—Sept. 7, the following insects were observed visiting the flowers for nectar:—

Hymenoptera—*Apidae*: (1) *Apis mellifica* L. ♀, ab.; (2) *Bombus americanorum* F. ♂; (3) *B. separatus* Cr. ♀; (4) *Epeolus remigatus* F.; *Andrenidae*: (5) *Agapostemon radiatus* Say ♂; (6) *Augochlora pura* Say ♂, ab.; (7) *Halictus lerouxii* Lep. ♂♀; (8) *H. fasciatus* Nyl. ♂, ab.; (9) *H. zephyrus* Sm. ♂; *Sphecidae*: (10) *Ammophila pictipennis* Walsh.

Lepidoptera—*Rhopalocera*: (11) *Pieris protodice* B.-L.; (12) *Pholisora catullus* F.; (13) *Eudamus tityrus* F.

Diptera—*Bombylidae*: (14) *Systoechus vulgaris* Lw.; (15) *Exoprosopa fasciata* Mcq., ab.

VERBENA URTICAEFOLIA L.—The flowers are white, much smaller than in the preceding, and are arranged in long loose spikes. Blooms from June 29 to Sept 7, or later. On 8 days July 11—Aug. 29, I observed the following insects, all sucking:—

Hymenoptera—*Apidae*: (1) *Apis mellifica* L. ♂; (2) *Bombus americanorum* F. ♂♂; *Andrenidae*: (3) *Augochlora pura* Say ♂; (4) *Halictus ligatus* Say ♀; (5) *H. confusus* Sm. ♀.

Diptera—*Empidae*: (6) *Empis clausa* Rob. (MS.); *Conopidae*: (7) *Stylogaster neglecta* Will.; *Syrphidae*: (8) *Mesograpta geminata* Say; (9) *Sphaerophoria cylindrica* Say; (10) *Syritta pipiens* L.

Lepidoptera—*Rhopalocera*: (11) *Pieris protodice* B.-L.; (12) *P. rapae* L.

PHRYMA LEPTOSTACHYA L.—The plant grows in damp woods and is not very common. I have found it in bloom from July 10 to Sept. 3. The stem rises about 6 dm. high and bears several branches terminating in slender spikes, which commonly show but two flowers open at a time.

The flower and its three-lobed lower lip project horizontally, the short, slightly notched upper lip diverging in an upward direction. The corolla is white, tinged with pinkish, the upper lip being almost entirely pink. It measures 8 mm. in length, its tube 5 mm., the lower lip 4 mm. in width. The lower wall of the corolla is strongly infolded forming a sort of palate which presents on each side a ridge provided with numerous stiff hairs. This structure narrows the entrance so as to exclude short tongues and to require long tongues to touch the anthers and stigma. Small bees can force their heads into the tubes by forcing down the palate. The flowers are strongly proterandrous, and are visited by *Augochlora pura* Say ♂.

PHYTOLACCA DECANDRA L.—The stems of this common plant rise 2 m. or more, are much branched and bear numerous racemes of small whitish flowers. The five ovate, white sepals are incurved but expand so that the flower measures about 5 mm. across.

The flowers are proterandrous with a homogamous stage. Cross-fertilization between flowers of the same or of distinct plants may occur, and even self-pollination may occur by in-

sect aid. In absence of insects spontaneous self-fertilization may readily take place.¹

The nectar is exposed. The flowers are visited by short-tongued Hymenoptera and Diptera, especially species of *Halictus*. I have found the plant in bloom from June 14 to Oct. 15. On July 17 and 23 I observed the following visitors:—

Hymenoptera—*Apidae*: (1) *Apis mellifica* L. ♀, s.; *Andrenidae*: (2) *Halictus ligatus* Say ♂, s.; (3) *H. fasciatus* Nyl. ♂, s.; (4) *H. confusus* Sm. ♀, s. and c. p., ab.; (5) *H. zephyrus* Sm. ♀, s.; (6) *H. stultus* Cr. ♂♀, s. and c. p., ab.; *Vespidæ*: (7) *Polistes metricus* Say, s.; *Pompilidae*: (8) *Priocnemis fulvicornis* Cr., s.

Diptera—*Empidæ*: (9) *Empis clausa* Rob. (MS.) s.; *Syrphidae*: (10) *Mesograpta geminata* Say, s.; (11) *Syritta pipiens* L., s., ab.; *Tachinidae*: (12) *Jurinia apicifera* Wlk. s.

HYPOXIS ERECTA L.—This plant is quite common in prairies and woods. The scapes, generally one to each plant, rise one or two dm., usually exposing only one open flower at a time. The flowers are yellow, the lanceolate divisions expanding horizontally from 12 to 25 mm. The six stamens are strongly divergent, the stigma occupying the centre of the circle, so that in absence of insects self-pollination cannot occur, unless it happens after the flowers close.

As a rule, insect visits result in cross-fertilization between distinct plants, but may also result in self-pollination.

The flowers are visited only for pollen, and depend especially upon *Halictus*. I have found them in bloom from April 28 to June 12. May 19 and 22 I observed as visitors:—

Hymenoptera—*Apidae*: (1) *Ceratina dupla* Say ♀, ab.; *Andrenidae*: (2) *Augochlora pura* Say ♀, ab.; (3) *Halictus pectoralis* Sm. ♀; (4) *H. coriaceus* Sm. ♀; (5) *H. ligatus* Say ♀; (6) *H. cressonii* Rob. ♀; (7) *H. stultus* Cr. ♀; (8) *H. tegularis* Rob. ♀; (9) *H. anomalus* Rob. ♀—all collecting pollen.

Diptera—*Syrphidae*: (10) *Mesograpta geminata* Say; (11) *Sphaerophoria cylindrica* Say; *Anthomyidae*: (12) *Chortophila* sp.

Coleoptera—*Buprestidae*: (13) *Acmaeodera culta* Web.—all feeding on pollen.

ERYTHRONIUM ALBIDUM Nutt.—This is one of the first flowers of spring, and is quite common. The flower bud ap-

¹According to Meehan, Proc. Acad. Nat. Sci. Phil. 1890, 272, the flower is spontaneously self-fertilized before opening.

pears with a pair of leaves and rises on a scape only a few centimetres above the ground. Owing to a bend in the scape, the flower looks outward and downward, or directly downward. The divisions of the perianth are white, tinged with purplish exteriorly, and marked with yellow at the base within, especially the three petals, which hold nectar on the bases of their claws. At base the divisions are closely approximated, forming a tube about 15 mm. in length, and making the nectar hard to reach except by insects with long tongues; beyond they are directed outward and downward, or may be expanded horizontally so that the flower measures 65 mm. across, or they may be so strongly reflexed that their tips meet, as in the case of plants growing in rich bottom soil.

The anthers of the three outer, shorter stamens dehisce first. At this time, if an insect come with pollen, it will leave some upon the stigma, which is somewhat in advance of the dehiscent anthers; otherwise, it may effect self-pollination. Cross-fertilization may readily occur at any time, but when the inner anthers dehisce, they may easily leave some of their pollen upon the stigma, since they usually surpass the stigma a little. Accordingly, in absence of insects, I think that self-pollination commonly occurs.

The pendulous position of the flower has the effect of restricting the visitors almost exclusively to bees, since they can readily cling to the stamens and style. The first flowers, which appear before flower insects become common, are visited almost exclusively by hive-bees.

For the attention of insects the plant is in competition with *Anemonella thalictroides*, *Isopyrum bitermum*, *Sanguinaria Canadensis*, *Viola palmata*, *Claytonia Virginica* and *Dentaria laciniata*. Competition with *Claytonia* is most severe; I have found it difficult to collect the visitors of *Erythronium* until afternoon, after the flowers of the *Claytonia* had closed.

I have found the plant in bloom from Mar. 17 to Apr. 22. On 13 days, between Apr. 7 and 19, I saw the flowers visited by:—

Hymenoptera — *Apidae*: (1) *Apis mellifica* L. ♂, s. and c. p., ab.; (2) *Bombus virginicus* Oliv. ♀, s., one; (3) *Ceratina dupla* Say ♂, s.; (4) *Osmia atriventris* Cr. ♂, s., ab.; (5) *O. albiventris* Cr. ♂♀, s., ab.; (6) *O. lignaria* Say ♂, s.; (7) *O. latitarsi* Cr. ♂, s.; (8) *Nomada luteola* Lep. ♂, s., ab.; *Andrenidae*: (9) *Andrena bicolor* F. ♂♀, s., ab.; (10) *A. sayi* Rob. ♂, s.; (11) *A.*

erythronii Rob. ♂♀, s. and c. p., ab.; (12) *A. mariae* Rob. ♀, s.; (13) *Halictus lerouxii* Lep. ♀, s.; (14) *H. fasciatus* Nyl. ♀, s.; (15) *H. confusus* Sm. ♀, s.; (16) *Colletes inaequalis* Say ♂, s. ab.

Lepidoptera—*Rhopalocera*: (17) *Pieris rapae* L., s.; (18) *Colias philodice* Godt., s.; (19) *Nisoniades juvenalis* F., s.

Diptera — *Bombylidae*: (20) *Bombylius fratellus* Wd., s., one; *Syrphidae*: (21) *Brachypalpus frontosus* Lw., f. p., one; *Muscidae*: (22) *Lucilia cornicina* F., s., not touching stigma.

TRADESCANTIA VIRGINICA L. (smooth form).—The plant is smooth and glaucous with linear leaves, the stems rising 3 to 6 dm. and bearing from one to three umbel-like clusters of flowers, each umbel in turn with from 1 to 5 open flowers. The flowers are blue, expanding 3 or 4 cm., but retaining a shallow, bell-shaped form. The stigma is widely separated from the anthers and somewhat surpasses them. Spontaneous self-pollination is hardly probable while the flower is open. Cross-pollination between flowers of the same plant may occur, but owing to the small number of flowers exposed on one plant at a time, cross-pollination between flowers of distinct plants is much more probable.

The flowers are specially adapted to female bees, and other insects in search of pollen. The hairs on the stamens are foot-holds for the use of bees in collecting pollen.

The plant is in strong competition with *Rosa humilis* for the attention of pollen-visitors, *Tradescantia* having the advantage of abundance and *Rosa* of conspicuousness. But they avoid competition to some extent by dividing the visitors between them, *Rosa* taking the large ones and *Tradescantia* the small ones.

I have found it in bloom from May 22 to July 30. The following list of visitors was observed on June 4, 5 and 12:—

Hymenoptera—*Apidae*: (1) *Bombus pennsylvanicus* DeG. ♀; (2) *Bombus separatus* Cr. ♀; (3) *Synhalonia speciosa* Cr. ♀; (4) *Ceratina dupla* Say ♀; *Andrenidae*: (5) *Agapostemon nigricornis* F. ♀; (6) *Halictus pruinosus* Rob. ♀—all c. p.

Diptera—*Syrphidae*: (7) *Syrphus ribesii* L.; (8) *S. americanus* Wd.; (9) *Allograpta obliqua* Say; (10) *Mesograpta marginata* Say; (11) *Sphaerophoria cylindrica* Say; (12) *Tropidia mamillata* Lw.

Coleoptera—*Curculionidae*: (13) *Stethobaris* sp.—all f. p.

Carlinville, Ill.